Lesson 17: Analyzing Residuals

Classwork

Example 1: Predicting the Pattern in the Residual Plot

Suppose you are given a scatter plot and least-squares line that looks like this:



Describe what you think the residual plot would look like.

The residual plot has an arch shape, like this:

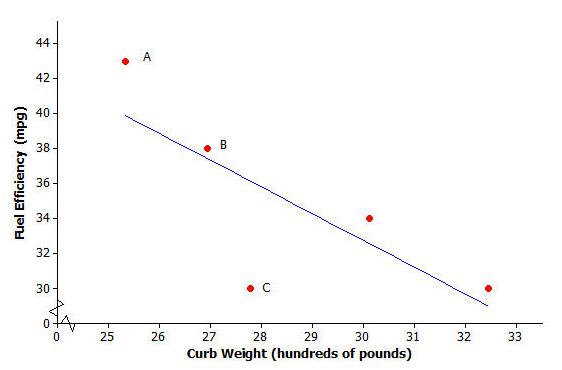


Why is looking at the pattern in the residual plot important?

Example 2: The Meaning of Residuals

Suppose that you have a scatter plot and that you have drawn the least-squares line on your plot. Remember that the residual for a point in the scatter plot is the vertical distance of that point from the least-squares line.

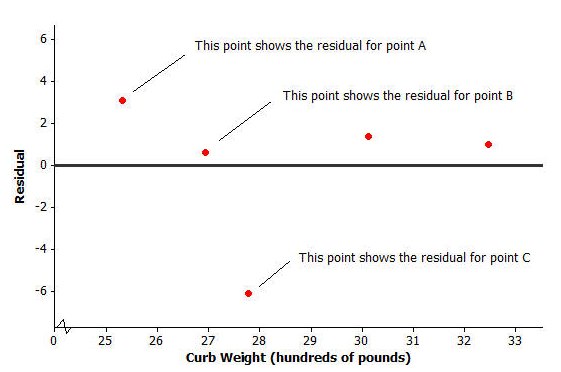
In the previous lesson, you looked at a scatter plot showing how fuel efficiency was related to curb weight for five compact cars. The scatter plot and least-squares line are shown below.



Consider the following questions:

* What kind of residual will Point A have?
* What kind of residual will Point B have?
* What kind of residual will Point C have?

You also looked at the residual plot for this data set:



Your teacher will now show how to use a graphing calculator or graphing program to construct a scatter plot and a residual plot. Consider the following exercise.

Example 3: Using a Graphing Calculator to Construct a Residual Plot

In an earlier lesson you looked at a data set giving the shoe lengths and heights of 12 adult women. This data set is shown in the table below.

|  |  |
| --- | --- |
| **Shoe Length (*x*)** | **Height (*y*)** |
| inches | inches |
| 8.9 | 61 |
| 9.6 | 61 |
| 9.8 | 66 |
| 10.0 | 64 |
| 10.2 | 64 |
| 10.4 | 65 |
| 10.6 | 65 |
| 10.6 | 67 |
| 10.5 | 66 |
| 10.8 | 67 |
| 11.0 | 67 |
| 11.8 | 70 |

Use a calculator to construct the scatter plot (with least-squares line) and the residual plot for this data set.

Problem Set

Lesson Summary

* After fitting a line, the residual plot can be constructed using a graphing calculator.
* A pattern in the residual plot indicates that the relationship in the original data set is not linear.

Consider again a data set giving the shoe lengths and heights of 10 adult men. This data set is shown in the table below.

|  |  |
| --- | --- |
| **Shoe Length (*x*)** | **Height (*y*)** |
| inches | inches |
| 12.6 | 74 |
| 11.8 | 65 |
| 12.2 | 71 |
| 11.6 | 67 |
| 12.2 | 69 |
| 11.4 | 68 |
| 12.8 | 70 |
| 12.2 | 69 |
| 12.6 | 72 |
| 11.8 | 71 |

1. Use your calculator or graphing program to construct the scatter plot of this data set. Include the least-squares line on your graph. Explain what the slope of the least-squares line indicates about shoe length and height.
2. Use your calculator to construct the residual plot for this data set.
3. Make a sketch of the residual plot on the axes given below. Does the scatter of points in the residual plot indicate a linear relationship in the original data set? Explain your answer.

